United States
Office of Personnel Management

FWS Job Grading Standard for Machinist

3414

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Workforce Compensation and Performance Service
Classification Programs Division
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WORK COVERED

This standard covers nonsupervisory work involved in the manufacture and repair of parts and items of equipment which require the use of various types of standard and special machine tools and their attachments to machine metals, metal alloys, and other materials.

The work requires skill in the initial-planning of necessary work sequences, laying out reference points and lines to be followed in the machining processes, planning for and setting up the work in the machine, selecting and shaping metal cutting tools, operating all types of machine tools, and performing precision handwork to fit, finish, and assemble machined parts and equipment.

The work requires a knowledge of the makeup of blueprints and drawings and the skill necessary to interpret them; and skill in working from other types of specifications such as sketches, models of parts to be manufactured, or work orders.

WORK NOT COVERED

The following kinds of work are not covered by this standard:

-- Operating machine tools to perform specific machining operations which do not require initial work planning, work lay out, determining machines to be used, and proper work sequences (see Machine Tool Operator, 3431).

-- Planning and fabricating research and prototype models using machinist trade processes in combination with those of one or more other trades (see Model Maker, 4714).

-- Planning and fabricating research and prototype instruments using machinist trade processes in combination with those of one or more other trades (see Instrument Maker, 4712).

-- Fabricating, manufacturing, calibrating, reconditioning, and repairing tools, jigs, fixtures, dies, punches, and gages used in the manufacture overhaul, and repair of equipment (see Toolmaker, 3416).

-- Disassembling, repairing, and installing marine engines and equipment aboard vessels such as propelling machinery, auxiliaries, pumps, cargo-handling gear, and firefighting machinery in connection with repair of vessels and harbor craft (see Marine Equipment Repairing Series, 6203).

-- Installing, erecting, dismantling, and moving heavy equipment such as machine tools, conveyors, hoists, and compressors including replacing parts, truing shafts, and leveling ways on various machines and equipment (see Equipment Mechanic Series, 5352).

TITLES

Jobs covered by this standard are to be titled *Machinist.*

GRADE LEVELS

This standard does not describe all possible levels at which jobs might be established. If jobs differ substantially from skill, knowledge, and other requirements described in the grade levels of this standard, they may be graded above or below these grades based on the application of sound job grading methods.

HELPER AND INTERMEDIATE JOBS

Helper and Intermediate Machinist jobs are covered by the Job Grading Standards for Trades Helper and Intermediate Jobs. (WG-10 level in this standard is to be used as the "journey level" in applying the Intermediate Job Grading Table.)

3414-10 Machinist, Grade 10 3414-10

General: WG-10 Machinists manufacture parts and items of equipment from raw stock of different kinds of metals and metal alloys and other materials; or perform work involved in the manufacture of castings, forgings, weldments, and other fabrications, through the use of machine tools and precision handwork. The work requires that they set up and operate most types of conventional machine tools such as lathes, vertical and horizontal boring mills; bench, plain, or universal milling machines; shapers; planers; internal and external grinders; thread grinders; and radial drills. They frequently use a variety of auxiliary machine tool attachments such as rotary vises, dividing heads, taper attachments, magnetic chucks, vertical milling heads, tapping attachments, rotary tables and others.

They lay out work from blueprints, sketches, work orders, model of part to be made, or other specifications; determine which machine tool would best be used for each operation to be performed, which attachments are to be used on each machine, and the proper sequence of operations on each machine; and make new job setups on a variety of different types of equipment involving accurate alignment in order to maintain specified overall tolerances.

WG-10 Machinists determine speeds, feeds, and coolants, lubricants or abrasives to be used to cut, turn, drill, mill, bore, tap, ream, lap, hone, shape, grind, or finish item. They maintain dimensional accuracy during these processes through the use of precision measuring instruments such as vernier calipers, inside and outside micrometers, surface gages, height gages, squares, dial indicators and comparators. They use shop mathematics and handbook formulas in computing dimensions and in planning and laying out their work.

WG-10 Machinists perform duties in accordance with general instructions from their supervisors which normally include detailed blueprints or drawings, and specifications for the material to be used and design of the end item.

Skill and Knowledge: WG-10 Machinists apply skill in performing the full range of operations on most types of conventional machine tools and their various attachments. They use a knowledge of the machinability of numerous metals and other materials, and the proper tools required to produce the desired cuts and surfaces on each material. They exercise skill in planning and laying out work from work sheets, blueprints, sketches, or other work specifications. They determine work procedures, machines, tool, equipment, and attachments to be used; proper type and size of raw stock needed; sequence of machining operations on each machine tool, and the speeds and feeds necessary to attain the required finishes and tolerances based on the type of tools to be used and the material to be machined.

WG-10 Machinists apply shop mathematics and handbook formulas in establishing needed dimensions, such as those required for chasing threads or machining angular surfaces; locating and marking surfaces and angles to be machined, locating reference points, or performing other layout work necessary to facilitate accurate job setups on a variety of machine tools. They often

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manufactures an entire item, carrying out all the machining operations necessary for completion, and performing precision handwork such as filing, scraping and lapping to fit, assemble, and finish machined parts.

WG-10 Machinists are skilled in using many types of precision measuring instruments and equipment. They frequently use such measuring devices as vernier calipers, height gages, squares, protractors, inside, outside and depth micrometers, surface gages, vee blocks, parallels, gage blocks, dial indicators, optical and mechanical comparators, and "go" and "no-go" thread, ring, and plug gages to attain accurate dimensions and maintain tolerances.

Work at this level requires mental application and concentration in reading and interpreting complex, multiview blueprints; locating and extracting critical dimensions and key reference points; and making the mathematical computations involved in transferring them from blueprint or drawing to the casting or raw stock during the job layout process.

Responsibility: WG-10 Machinists receive work assignments in the form of work orders or oral instructions accompanied by blueprints, sketches, drawings, model of part, or other work specifications. They determine the most efficient work procedures; machine tools and attachments to be used; and proper sequence of machining operations. They are responsible for laying out their own work, accurately computing and checking dimensions and tolerances, setting up the job in the machine, and selecting the proper tools to achieve the desired dimensions, tolerances, and surface finishes.

WG-10 Machinists make independent judgments and decisions within the framework of oral and written instructions and accepted trade practices, processes, and procedures while accomplishing his assignments. For example, they make such decisions as the most efficient and economical machine to use for a machining process that could be performed on any of several machines; the best and safest methods to employ in securing and holding a part to be machined; the maximum depth of a particular cut considering the composition of the material to be cut and the stress the cutting tool will withstand; and the amount of metal which must be left on a part for grinding purposes, considering possible shrinkage or warpage during the heat treating or hardening process.

The supervisor is usually available for consultation on unique problems or in progress design changes. The work is reviewed by the supervisor only to insure that it meets specifications and accepted trade practices.

Physical Effort: The work of WG-10 Machinists requires standing, stooping, bending, and reaching; and frequent handling of objects weighing up to 5 kilograms (10 pounds) and occasionally objects weighing as much as 18 kilograms (40 pounds); however, hoists, hand trucks, lifts, and other workers are available to assist with heavier items.

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Working Conditions: WG-10 Machinists work inside in areas that are usually-noisy and dirty, and where there is a danger to skin and eyes from flying metal chips, abrasive particles, and hot metal; skin irritation from contact with coolants, lubricants, and abrasive compounds; and danger to the fingers, hands, and other parts of the body from cutting tools, grinding wheels, rotating work pieces, and moving parts of machines.

3414-11 Machinist, Grade 11 3414-11

General: WG-11 machinists, similar to machinists at the WG-10 level, manufacture parts and items of equipment from different metals and other materials and performs machining work in the manufacture of castings, forgings, weldments, and other fabrications but, in addition, WG-11 machinists receive assignments which usually require special adaption or extension of the use of conventional machine tools or the use of specialized or nonconventional machine tools such as jig borers, jig grinders, hobbing machines, hob grinders, gear generators, or numerically controlled machine tools.

Assignments at the WG-11 level normally require more numerous intricate steps in the manufacturing process, more exacting dimensions, or similar factors. The work typically involves the machining of surfaces at unusual or compound angles, items which require differential or compound indexing, multiple lead and various other nonstandard screw threads, helical or other types of gears, worm threads, or surfaces having closely interrelated dimensions or complex configurations; or machining operations on numerically controlled machine tools which require planning for and using such procedures as multiple setups, inplace machining of fixtures, debugging first-run programs, and making or suggesting changes to machine tool program's.

Work assignments at the WG-11 level require more skill and ingenuity in their completion than those at WG-10 in that they often require accomplishing untried tasks and procedures such as determining the right type of tool steel, rake and clearance angles needed on a cutting tool and the correct machine speeds and feeds to cut a particular metal or alloy to required dimensions, tolerances and surface finishes; making independent interpretation and translation of work orders, drawings, and specifications which are often lacking in such items as dimensions, tolerances, and types of fits and finishes; planning and coordinating related work processes; and planning sequences of operations which involve original innovations in setups, attachments, techniques, and tools.

WG-11 machinists proceed on work assignments from initial assignment to completion. General supervision is provided in the form of instructions and suggestions by the supervisor. Completed work is checked only to see that the work specifications and accepted trade standards are met.

Skill and Knowledge: WG-11 machinists apply a comprehensive knowledge of and skill in using any of the accepted trade methods and techniques, and all conventional types of machine tools. In addition, they exercise skill and ingenuity in using conventional machine tools and their attachments to perform machining processes requiring special adaption of the equipment or processes for which they were not specifically designed, for example, through the use of special or improvised tools, fixtures, and setups to machine unusual surface configurations such as curved surfaces requiring machine feeds in two different planes simultaneously; surfaces having closely interrelated dimensions, or surfaces having unusual or compound angular relationships. WG-11 machinists are also skilled in setting up and operating specialized or nonstandard machine tools

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such as jig borers, jig grinders, hobbing machines, hob grinders, gear generators, and completely automatic machine tools which normally require extensive or involved mathematical computations in their setup or operating procedures.

In comparison with WG-10 machinists who apply shop mathematics and handbook formulas in establishing needed dimensions, the WG-ll machinist apply a greater knowledge of and more skill in using advanced shop mathematics, including geometric and trigonometric formulas, to make computations necessary to perform such tasks as laying out his work; setting up machines to machine pieces at unusual or compound angles; determining change gear ratios, pitch, lead, and pitch diameters for various standard and nonstandard screw threads, worms, and gear wheels; determining exact angles and dimensions necessary to locate and bore or grind precision holes; or determining plates and gearing to be used and pin locations for differential, compound, or angular indexing.

WG-11 Machinists are skilled in performing work assignments which require accomplishing untried tasks or procedures such as those required in machining a rare metal, new metal alloy, or other new material for which WG-11s determine the best tooling material, tool types, coolants, and machine feeds and speeds to use in performing a particular machining operation; or independent interpretation and translation of work orders, drawings and specifications frequently requiring computing and establishing missing tolerances, dimensions, and types of fits or finishes. Because work assignments are usually more general at this level and the performance of related work processes necessary to complete an entire job are not specifically provided for in work specifications. Therefore, the WG-11 apply a knowledge of the effect and relationship of heat treating, annealing, plating, welding, and other related work processes on various machining operations in order to efficiently plan and coordinate these operations in completing an assignment. Based on their extensive overall knowledge of the trade, they plan sequences of operations which involve innovations in setups, attachments, techniques, and tooling.

WG-11 machinists maintain and use a knowledge of new machine tools, and machining procedures and techniques. They set up and operate machine tools such as electrical displacement or numerically controlled machine tools, using his trade knowledge and machining skills to contribute to the efficient use of these machines by suggesting and developing new setups and attempting new types of machining operations. For example, on numerically controlled machine tools he plans for, makes necessary computations, and accomplishes operations using multiple setups. They set up machine operation to attain precise dimensions through in-place machining of fixtures; edit program tapes by machining the "first piece" and, after checking dimensional accuracy, make the necessary corrections to the machine operation through manual input or changes to the program tape before turning operation of the machine over to a lower level worker; or, if the machining operations require extensive manual input or precise nonstandard machining operations or procedures, he operates the numerically controlled machine to complete the entire job.

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WG-11 machinists use a thorough knowledge of all aspects of the machining occupation as well as extensive knowledge of related trades in order to resolve problems concerning complex machining operations or procedures and suggest new or alternative methods where necessary, more efficient, or more economic.

Responsibility: Assignments received by WG-11 machinists are in the form of work orders or oral instructions and are of the type which normally require independent review, interpretation, translation, and often corrections or adjustments on the part of the workers at this level. When blueprints or drawings are provided, they are usually difficult to read in that they consist of sets or series of interrelated prints, often with oblique or isometric projections, which require study to locate, interpret and translate, or compute needed dimensions. They frequently require preparing a new sketch in order to place dimensions of particular parts or related surfaces into better perspective, and calculating and establishing missing dimensions or tolerances and inserting such items into the work orders.

WG-11 machinists are responsible for independently performing tasks requiring accuracy and mental application in the use of advanced shop mathematics beyond that required at the WG-10 level, involving algebraic, geometric, and trigonometric formulas which are needed to established gear trains to produce a specific lead or pitch; make computations necessary in differential, compound, or angular indexing procedures; determine relationships between or measure compound angles; or compute pitch and root diameters for various types of threads, worms, or gears.

In comparison with the work performed by machinists at the WG-10 level, work assignments at this level require more independent judgments and decisions on the part of the workers and provide for greater leeway in methods and procedures for accomplishing his assignment. WG-11 machinists are responsible for a wider scope of machining operations, including extending the use of conventional machine tools and setting up and operating the more precise or nonstandard machines. They use a greater degree of independent judgment in determining the need for and improvising special setups and procedures on conventional machine tools to perform machining operations which have not been tried before, occur on a one-time or infrequent basis, require machining to tolerances which are difficult to attain or hold, or require machining of unusual surface configurations.

WG-11 Machinists are responsible for suggesting and using alternate methods and procedures which contribute toward more efficient and economic machining operations, greater dimensional accuracy, or savings in machining time. They are depended upon for their judgment and decisions relative to the use of new machine tools for particular types of jobs and, generally, keeping abreast of technological changes in the machining occupation.

Assignments are completed under general supervision and work or product is checked only for conformance to accepted trade practices or work specifications.

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Physical Effort: The physical effort required at this level of work s the same as that required at the WG-10 level.

Working Conditions: The working conditions encountered at the WG-11 level are the same as those found at the WG-10 level.